

# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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- 6 GHz frequency range
- 160 MHz RF modulation bandwidth
- 320 Mbytes baseband memory
- 6 Gbyte non-volatile waveform storage



### E4438C RF Vector Signal Generator

The Agilent E4438C ESG vector signal generator meets the needs of engineers who are designing and developing the next generation of wireless communication systems and is well suited for production test environments. An assortment of standards-based receiver and component test software for 3G and emerging communications formats are available to simplify the signal configuration process. The E4438C ESG vector signal generator's performance, extended frequency range, increased memory for waveform playback and storage, and application-specific personalities make it the clear choice for development and manufacturing from the component to the system level.

#### 6 GHz Frequency Range

E4438C ESG provides different frequency options to suit your need: 1, 2, 3, 4 or 6 GHz

#### 160 MHz RF Modulation Bandwidth

- Ideal for multi-carrier signals
- Up to 160 MHz RF modulation bandwidth using external I/Q inputs
- 80 MHz RF modulation bandwidth using internal baseband generator

#### 320 Mbytes Baseband Memory

- 64 Msamples (320 Mbytes) for waveform playback
- 64x the memory of the previous generation
- Build longer, more complex waveforms

#### 6 Gbytes Non-Volatile Memory

- 1.2 Gsamples (6 Gbytes) for storing waveforms and instrument states
- Eliminate waveform build times in manufacturing and development

### Powerful Standard Features

- Excellent spectral purity
- Electronic attenuator
- Simple softkey menu structure allows access to sophisticated features
- Built-in help
- Differential and single-ended I/Q outputs
- Suite of I/Q adjustments: gain, DC offsets, quadrature skew
- Save and recall instrument settings
- IntuiLink software allows easy data exchange from Microsoft® applications
- 10BaseT LAN and GPIB interfaces

### Superior Dual Mode Baseband Generator

- Dual mode capability supports both waveform playback and real-time signal generation
- 80 MHz RF modulation bandwidth
- 64 Msamples (320 Mbytes) of waveform playback memory
- Generate waveforms at up to 100 Msamples/s
- Hardware resampling technology eliminates need for multiple reconstruction filters
- 16-bit DAC for improved dynamic range
- Flexible baseband reference clock 250 kHz to 100 MHz
- Industry standard filters or user-definable FIR filters
- Set  $E_b/N_0$  or C/N ratio for W-CDMA, cdma2000, WiMAX, Digital Video, and more
- Generate AWGN with up to 80 MHz bandwidth
- Generate phase coherent carriers
- Polar modulation

### Baseband Studio

Baseband Studio is a suite of baseband signal applications and accessories that work with the E4438C ESG vector signal generator to emulate real-world signal conditions.

- Fading
- Digital inputs and outputs
- Waveform capture and playback
- CPRI RF test

For more information, go to page 341

### Signal Creation Software

The software is used for the development and generation of waveforms with the internal baseband generator.

- |                          |                                   |
|--------------------------|-----------------------------------|
| • TD-SCDMA               | • AWGN                            |
| • W-CDMA                 | • Noise power ratio               |
| • EDGE/GSM               | • Enhanced multitone              |
| • 1xEV-DO/1xEV-DV        | • Custom                          |
| • cdma2000/cdmaOne       | • Pulse                           |
| • NADC/PDC               | • $\Phi$ M/AM/FM                  |
| • PHS                    | • S-DMB                           |
| • DECT                   | • HSDPA                           |
| • TETRA                  | • Pulse building                  |
| • GPS                    | • Jitter injection                |
| • 802.11a/b/g/j/p/n WLAN | • 802.16 (WiMAX)                  |
| • Bluetooth™             | • Digital Video                   |
| • T-DMB                  | • DVB-T/H/C/S, ISDB-T, ATSC, DTMB |
| • Toolkit                |                                   |

For more information, go to page 310

## Specifications for Frequency and Power Characteristics

## Frequency

## Frequency Range

Option:

- 501: 250 kHz to 1 GHz
- 502: 250 kHz to 2 GHz
- 503: 250 kHz to 3 GHz
- 504: 250 kHz to 4 GHz
- 506: 250 kHz to 6 GHz (requires Option UNJ)

## Frequency Minimum

100 kHz<sup>1</sup>

## Frequency Resolution

0.01 Hz

Frequency Switching Speed<sup>4</sup>

	Option 501-504		Option 501-504 w/UNJ		With Option 506	
	Freq. <sup>2</sup>	Freq./Amp. <sup>3</sup>	Freq. <sup>2</sup>	Freq./Amp. <sup>3</sup>	Freq. <sup>2</sup>	Freq./Amp. <sup>3</sup>
Digital modulation on	(<35 ms)	(<49 ms)	(<35 ms)	(<52 ms)	(<41 ms)	(<57 ms)
Digital modulation off	(<9 ms)	(<9 ms)	(<9 ms)	(<9 ms)	(<16 ms)	(<17 ms)

[For hops &lt;5 MHz within a band]

## Digital modulation

on	(<9 ms)	(<9 ms)	(<9 ms)	(<9 ms)	(<33 ms)	(<53 ms)
off	(<9 ms)	(<9 ms)	(<9 ms)	(<9 ms)	(<12 ms)	(<14 ms)

## Phase Offset

Phase is adjustable remotely (LAN, GPIB, RS-232) or via front panel in nominal 0.1° increments

## Sweep Modes

## Operating Modes

Frequency step, amplitude step and arbitrary list

## Dwell Time

1 ms to 60 s

## Number of Points

2 to 65,535

## Internal Reference Oscillator (Option 1E5)

Stability<sup>4</sup>

Aging rate	<±1 ppm/yr <±0.1 ppm/yr or <±0.0005 ppm/day after 45 days
Temp (0 to 55° C)	(<±1 ppm) (<±0.05 ppm)
Line voltage	(<±0.1 ppm) (<±0.002 ppm)
Line voltage range	(+5% to -10%) (+5% to -10%)

## RF Reference Output

- Frequency: 10 MHz
- Amplitude: 4 dBm ±2 dB

## RF Reference Input Requirements

Frequency	1, 2, 5, 10 MHz ± 0.2 ppm
Amplitude	-3.5 dBm to 20 dBm
Input impedance	50 Ω

## Output Power

## Power

	Option 501-504	With Option UNB	Option 506
250 kHz to 250 MHz	+11 to -136 dBm	+15 to -136 dBm	+12 to -136 dBm
>250 MHz to 1 GHz	+13 to -136 dBm	+17 to -136 dBm	+14 to -136 dBm
>1 to 3 GHz	+10 to -136 dBm	+16 to -136 dBm	+13 to -136 dBm
>3 to 4 GHz	+7 to -136 dBm	+13 to -136 dBm	+10 to -136 dBm
>4 to 6 GHz	—	—	+10 to -136 dBm

## Level Resolution

0.02 dB

## Level Range with Attenuator Hold Active

	Option 501-504	With Option UNB	Option 506
250 kHz to 1 GHz	23 dB	27 dB	24 dB
>1 to 3 GHz	20 dB	26 dB	23 dB
>3 to 4 GHz	17 dB	23 dB	20 dB
>4 to 6 GHz	—	—	20 dB

## Level Accuracy [dB]

## Option 501-504

	Power Level			
	+7 to -50 dBm	-50 to -120 dBm	-120 to -127 dBm	<-127 dBm
250 kHz to 2 GHz	±0.5	±0.5	±0.7	(±1.5)
2 to 3 GHz	±0.6	±0.6	±0.8	(±2.5)
3 to 4 GHz	±0.6	±0.7	±0.8	(±2.5)

With Option UNB<sup>4,5</sup>

	Power Level			
	+10 to -50 dBm	-50 to -120 dBm	-120 to -127 dBm	<-127 dBm
250 kHz to 2 GHz	±0.5	±0.7	±0.8	(±1.5)
2 to 3 GHz	±0.6	±0.8	±1.0	(±2.5)
3 to 4 GHz	±0.8	±0.9	±1.3	(±2.5)

With Option 506<sup>4,6</sup>

	Power Level			
	+7 to -50 dBm	-50 to -110 dBm	-110 to -127 dBm	<-127 dBm
250 kHz to 2 GHz	±0.6	±0.8	±0.8	(±1.5)
2 to 3 GHz	±0.6	±0.8	±1.0	(±2.5)
3 to 4 GHz	±0.8	±0.9	±1.5	(±2.5)
4 to 6 GHz	±0.8	±0.9	(±1.5)	

## Level Accuracy with Digital Modulation Turned On (relative to CW)

Conditions:

(with PRBS modulated data; if using I/Q inputs,  $\sqrt{I^2 + Q^2} = 0.5 V_{rms}$ , nominal)<sup>4</sup>

## Level Accuracy with ALC on

Conditions: With raised cosine or root-raised cosine filter and  $\alpha \geq 0.35$ ;

with 10 kHz ≤ symbol rate ≤ 1 MHz; at RF freq ≥ 25 MHz; power ≤ max specified -3 dB

Option 501-504	±0.15 dB
With Option 506	±0.25 dB

Constant amplitude formats (FSK, GMSK, etc)

Option 501-504	±0.1 dB
With Option 506	±0.15 dB

Level Accuracy with ALC off<sup>4,7</sup>

Conditions: After power search is executed, with burst off.

Level Switching Speed<sup>4</sup>

	Option 501-504	Option UNB	Option 506
Normal operation [ALC on]	(<15 ms)	(<21 ms)	(<21 ms)
When using power search manual	(<83 ms)	(<95 ms)	(<95 ms)
When using power search auto	(<103 ms)	(<119 ms)	(<119 ms)

## Spectral Purity

SSB Phase Noise (at 20 kHz offset)<sup>4</sup>

	Option 501-504	With Option UNJ
at 500 MHz	(<-124 dBc/Hz)	<-135 dBc/Hz, (<-138 dBc/Hz)
at 1 GHz	(<-118 dBc/Hz)	<-130 dBc/Hz, (<-134 dBc/Hz)
at 2 GHz	(<-112 dBc/Hz)	<-124 dBc/Hz, (<-128 dBc/Hz)
at 3 GHz	(<-106 dBc/Hz)	<-121 dBc/Hz, (<-125 dBc/Hz)
at 4 GHz	(<-106 dBc/Hz)	<-118 dBc/Hz, (<-122 dBc/Hz)
at 6 GHz	N/A	<-113 dBc/Hz, (<-117 dBc/Hz)

Residual FM<sup>4</sup> (CW mode, 0.3 to 3 kHz BW, CCITT, rms)

- Option UNJ <N x 1 Hz (<N x 0.5 Hz)<sup>8</sup>
- Standard

- Phase noise mode 1 <N x 2 Hz
- Phase noise mode 2 <N x 4 Hz

<sup>1</sup> Performance below 250 kHz not guaranteed.<sup>2</sup> To within 0.1 ppm of final frequency above 250 MHz or within 100 Hz below 250 MHz.<sup>3</sup> Frequency switching time with the amplitude settled within ±0.1 dB.<sup>4</sup> Parentheses denote typical performance.<sup>5</sup> Quoted specifications for 23°C ± 5°C. Accuracy degrades by less than 0.01 dB/°C over full temperature range. Accuracy degrades by 0.2 dB above +10 dBm, and by 0.8 dB above +13 dBm.<sup>6</sup> Quoted specifications for 23°C ± 5°C. Accuracy degrades by less than 0.02 dB/°C over full temperature range. Accuracy degrades by 0.2 dB above +7 dBm.<sup>7</sup> When applying external I/Q signals with ALC off, output level will vary directly with I/Q input level.<sup>8</sup> Refer to frequency bands on next page for N values.

## Specifications For Analog Modulation

## Frequency Bands

Band	Frequency Range	N #
1	250 kHz to ≤250 MHz	1
2	>250 MHz to ≤500 MHz	0.5
3	>500 MHz to ≤1 GHz	1
4	>1 to ≤2 GHz	2
5	>2 to ≤4 GHz	4
6	>4 to ≤6 GHz	8

Frequency Modulation<sup>1,3</sup>

## Maximum Deviation

Option 501-504      With Option UNJ  
N x 8 MHz      N x 1 MHz

## Resolution

0.1% of deviation or 1 Hz, whichever is greater

Coupling	Modulation Frequency Rate <sup>4</sup> (deviation = 100 kHz)	
	1 dB Bandwidth	3 dB Bandwidth
FM path 1 (DC)	DC to 100 kHz	(DC to 10 MHz)
FM path 2 (DC)	DC to 100 kHz	(DC to 0.9 MHz)
FM path 1 (AC)	20 Hz to 100 kHz	(5 Hz to 10 MHz)
FM path 2 (AC)	20 Hz to 100 kHz	(5 Hz to 0.9 MHz)

**Deviation Accuracy<sup>2</sup>** (1 kHz rate, deviation <N x 100 kHz)  
<±3.5% of FM deviation + 20 Hz

Phase Modulation<sup>1,3</sup>

## Resolution

0.1% of set deviation

Modulation Frequency Response<sup>4,5</sup>

Standard

Mode	Maximum Deviation	Allowable Rates (3 dB BW)	
		ΦM Path 1	ΦM Path 2
Normal BW	N x 80 rad	DC to 100 kHz	DC to 100 kHz
High BW <sup>6</sup>	N x 8 rad	(DC to 1 MHz)	(DC to 0.9 MHz)
	N x 1.6 rad	(DC to 10 MHz)	(DC to 0.9 MHz)

With Option UNJ

Mode	Maximum Deviation	Allowable Rates (3 dB BW)	
		ΦM Path 1	ΦM Path 2
Normal BW	N x 10 radians	DC to 100 kHz	DC to 100 kHz
High BW	N x 1 radians	(DC to 1 MHz)	(DC to 0.9 MHz)

**Deviation Accuracy** (1 kHz rate, Normal BW mode)

<±5% of deviation + 0.01 radians

**Distortion<sup>5</sup>** (1 kHz rate, deviation <80 radians on Options 501-504,  
<10 N radians on Option UNJ models, Normal BW mode) <1%

Amplitude Modulation<sup>1,5</sup> (f<sub>c</sub> >500 kHz)

## Range

0 to 100%

## Resolution

0.1%

## Rates (3 dB bandwidth)

- DC coupled: 0 to 10 kHz
- AC coupled: 10 Hz to 10 kHz

**Accuracy<sup>4,7</sup>** 1 kHz rate <±(6% of setting + 1%)

**Distortion<sup>4,7</sup>** (1 kHz rate, THD)

	Option 501-504/Option UNJ	Option 506
30% AM	<1.5%	<1.5%
90% AM	(<4%)	(<5%)

## Wideband AM

**Rates** (1 dB bandwidth)<sup>4</sup>

ALC on (400 Hz to 40 MHz)  
ALC off (DC to 40 MHz)

## Pulse Modulation

On/Off Ratio<sup>4</sup>

<4 GHz >80 dB

≤4 GHz (>64 dB)

Rise/Fall Times<sup>4</sup>

(150 ns)

Minimum Width<sup>4</sup>

ALC on (2 μs)

ALC off (0.4 μs)

Pulse Repetition Frequency<sup>4</sup>

ALC on (10 Hz to 250 kHz)

ALC off (DC to 1.0 MHz)

**Level Accuracy<sup>4,5</sup>** (relative to CW at ≤4 dBm Option 501-504, ≤7.5 dBm  
Option UNB, ≤4.5 dBm Option 506)  
(<±1 dB)

## Internal Pulse Generator

- Square wave rate: 0.1 Hz to 20 kHz

- Pulse

Period: 8 μs to 30 seconds

Width: 4 μs to 30 seconds

Resolution: 2 μs

## Internal Analog Modulation Source

(Provides FM, AM, pulse, and phase modulation signals and LF audio out)

## Waveforms

sine, square, ramp, triangle, pulse, noise

## Rate Range

Sine 0.1 Hz to 100 kHz

Square, ramp, triangle 0.1 Hz to 20 kHz

## Resolution

0.1 Hz

## Frequency Accuracy

same as RF reference source

## Swept Sine Mode (frequency, phase continuous)

Operating modes Triggered or continuous sweeps

Frequency range 0.1 Hz to 100 kHz

Sweep time 1 ms to 65 sec

Resolution 1 ms

## Dual Sinewave Mode

Frequency range 0.1 Hz to 100 kHz

Amplitude ratio 0 to 100%

Amplitude ratio Resolution 0.1%

## External Modulation Inputs

## Modulation Types

Ext 1 FM, ΦM, AM, pulse, and burst envelope

Ext 2 FM, ΦM, AM, and pulse

LQ/HI Indicator (100 Hz to 10 MHz BW, AC coupled inputs only). Activated when input level error exceeds 3% (nominal)

## External Burst Envelope

## Input Voltage

RF On: 0 V

RF Off: -1.0 V

Linear Control Range: 0 to -1 V

On/Off Ratio<sup>4</sup>

Condition: V<sub>m</sub> below -1.05 V

<4 GHz >75 dB

≥4 GHz (>64 dB)

Rise/Fall Time<sup>4</sup>

Condition: With rectangular input (<2 μs)

Minimum Burst Repetition Frequency<sup>4</sup>

ALC on (10 Hz)

ALC off DC

## Input Port

External 1

## Input Impedance

50 Ω, nominal

## Composite Modulation

AM, FM, and ΦM each consist of two modulation paths which are summed internally for composite modulation. The modulation sources may be any two of the following: Internal, External 1, External 2

## Simultaneous Modulation

Multiple modulation types may be simultaneously enabled with some exceptions. Two modulation types cannot be generated simultaneously by the same modulation source

<sup>1</sup> All analog performance above 4 GHz is typical.

<sup>2</sup> Refer to frequency bands on this page to compute specifications.

<sup>3</sup> For non-Option UNJ units, specifications apply in phase noise mode 2 (default).

<sup>4</sup> Parentheses denote typical performance.

<sup>5</sup> Refer to frequency bands on this page for N.

<sup>6</sup> AM is typical above 3 GHz or if wideband AM or I/Q modulation is simultaneously enabled.

<sup>7</sup> Peak envelope power of AM must be 3 dB less than maximum output power below 250 MHz.

<sup>8</sup> Bandwidth is automatically selected based on deviation.

<sup>9</sup> With ALC off, specifications apply after the execution of power search. With ALC on, specifications apply for pulse repetition rates ≤10 kHz and pulse widths ≥5 μs.

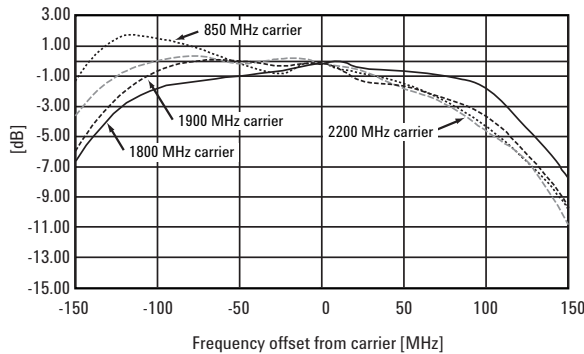


## Specifications For I/Q Characteristics

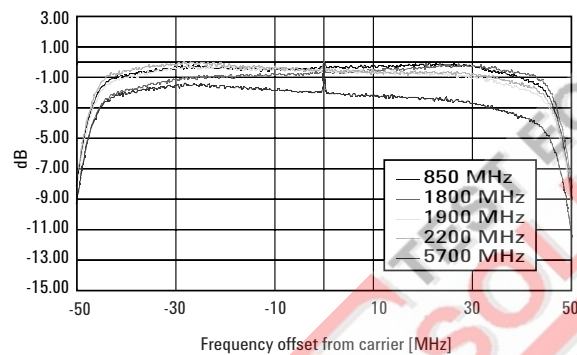
## I/Q Modulation Bandwidth

## I/Q Inputs

Input impedance 50  $\Omega$  or 600  $\Omega$   
 Full scale input<sup>1</sup>  $\sqrt{I^2 + Q^2} = 0.5 V_{rms}$

I/Q Bandwidth Using External I/Q Source (ALC off)<sup>2</sup>

## I/Q Bandwidth Using Internal I/Q Source



## I/Q Adjustments

Source	Parameter	Range
I/Q baseband inputs	Impedance	50 or 600 $\Omega$
	I offset (600 $\Omega$ only)	$\pm 5 V$
	Q offset (600 $\Omega$ only)	$\pm 5 V$
I/Q baseband outputs	I/Q offset adjustment	$\pm 3 V$
	I/Q offset resolution	1 mV
	I/Q gain balance	$\pm 4 dB$
	I/Q attenuation	0 to 40 dB
	I/Q low pass filter	40 MHz, through
RF output	I/Q offset adjustment	$\pm 50\%$
	I/Q gain balance	$\pm 4 dB$
	I/Q attenuation	0 to 40 dB
	I/Q quad skew ( $\leq 3.3 GHz$ )	$\pm 10^\circ$
	I/Q quad skew ( $> 3.3 GHz$ )	$\pm 5^\circ$
	I/Q low pass filter	2.1 MHz, 40 MHz, through

## Baseband Generator (arbitrary waveform mode) (Option 601 or 602)

## Channels

2 (I and Q)

## Resolution

16 bits (1/65,536)

## Arbitrary Waveform Memory

- Maximum playback capacity
  - 8 Msamples/channel (Option 601)
  - 64 Msamples/channel (Option 602)
- Maximum storage capacity
  - 1.2 Gsamples (Option 005)
  - 2.8 Msample (Standard)

## Waveform Segments

- Segment length: 60 samples to 8 Msamples or 64 Msamples
- Maximum number of segments
  - 1,024 (8 Msamples volatile memory)
  - 8,192 (64 Msamples volatile memory)
- Minimum memory allocation: 256 samples or 1 kbyte blocks

## Waveform Sequences

- Maximum total number of segment files stored in the non-volatile file system: 16,384
- Sequencing: Continuously repeating
- Maximum number of sequences 16,384 (shared with number of segments)
- Maximum segments/sequence: 32,768 (including nested segments)
- Maximum segment repetitions: 65,536

## Clock

Sample rate: 1 Hz to 100 MHz

Resolution: 0.001 Hz

Accuracy: same as timebase  $\pm 2^{-42}$  (in non-integer applications)

## Baseband Filters

40 MHz: used for spur reduction

2.1 MHz: used for ACPR reduction

Through: used for maximum bandwidth

Reconstruction Filter: (fixed)

50 MHz: (used for all symbol rates)

## Triggers

Types: Continuous, single, gated, segment advance

Source: Trigger key, external, remote (LAN, GPIB, RS-232)

External polarity: Negative, positive

External delay time: 10 ns to 40 sec plus latency

External delay resolution: 10 ns

## Markers

(Markers are defined in a segment during the waveform generation process, or from the ESG front panel. A marker can also be tied to the RF blanking feature of the ESG.)

Marker polarity: Negative, positive

Number of markers: 4

## Multicarrier

Number of carriers: Up to 100 (limited by a max bandwidth of 80 MHz depending on symbol rate and modulation type)

Frequency offset (per carrier): -40 MHz to +40 MHz

Power offset (per carrier): 0 dB to -40 dB

## Modulation

PSK: BPSK, QPSK, OQPSK,  $\pi/4$ QPSK, 8PSK, 16PSK, D8PSK

QAM: 4, 16, 32, 64, 128, 256

FSK: Selectable: 2, 4, 8, 16

MSK

ASK

## Data

Random ONLY

## Multitone

Number of tones: 2 to 64, with selectable on/off state per tone

Frequency spacing: 100 Hz to 80 MHz

Phase (per tone): Fixed or random

<sup>1</sup> The optimum I/Q input level is  $\sqrt{I^2 + Q^2} = 0.5 V_{rms}$ . I/Q drive level affects EVM, origin offset, spectral regrowth, and noise floor. Typical, level accuracy with ALC on will be maintained with drive levels between 0.25 and 1.0  $V_{rms}$ .

<sup>2</sup> Plots represent typical performance.

E4438C

**Baseband Generator** (real-time mode) (Option 601 or 602)**Basic Modulation Types** (custom format)

- PSK: BPSK, QPSK, OQPSK,  $\pi/4$ DQPSK, 8PSK, 16PSK, D8PSK
- MSK: User-defined phase offset from 0 to 100°
- ASK: User-defined depth from 0.001 to 100%
- QAM: 4, 16, 32, 64, 128, 256
- FSK

- Selectable: 2, 4, 8, 16 level symmetric, C4FM
- User defined: Custom map of up to 16 deviation levels:
 

Symbol rate	Maximum Deviation
<5 MHz	4 times symbol rate
>5 MHz, <50 MHz	20 MHz
- Resolution: 0.1 Hz

**I/Q**

Custom map of 256 unique values

**FIR Filter**Nyquist, root Nyquist, Gaussian, rectangular, APCO 25, Custom FIR  $\alpha$ : 0 to 1,  $B_p T$ : 0.1 to 1**Symbol Rate**

Adjustable up to 50 Mb/s/sec

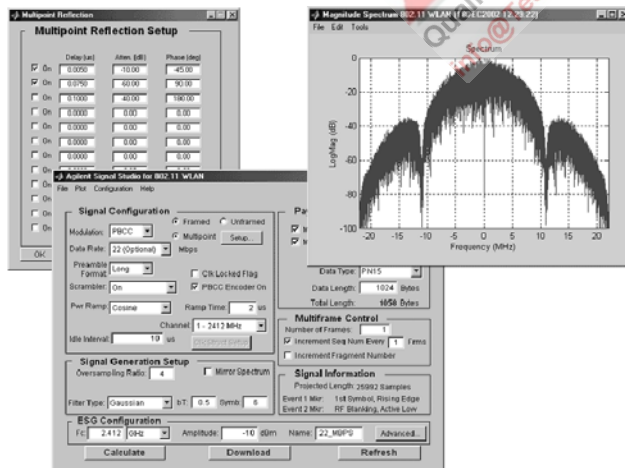
**Data Types**

- Internally generated data
  - Pseudo-random patterns
    - PN9, PN11, PN15, PN20, PN23
  - Repeating sequence
    - Any 4-bit sequence
    - Other fixed patterns
- Direct-pattern RAM (PRAM)
  - Max size
    - 8 Mb/s (Option 601)
    - 64 Mb/s (each bit uses an entire sample space) (Option 602)
  - Use
    - Non-standard framing
- User File
  - Max size
    - 800 kbytes (Option 601)
    - 6.4 Mbytes (Option 602)
  - Use
    - Continuous modulation or internally generated TDMA standard
- Externally Generated Data
  - Type
    - Serial data
  - Inputs
    - Data, bit clock, symbol sync
    - Accepts data rates  $\pm 5\%$  of specified data rate

**Internal Burst Shape Control**

Rise/fall time range: Up to 30 bits

Rise/fall delay range: 0 to 63.5 bits

**E4438C Key Literature & Web Link**

E4438C ESG Vector Signal Generator Data Sheet, p/n 5988-4093EN

Agilent E4438C ESG Vector Signal Generator Brochure, p/n 5988-3935EN

E4438C ESG Vector Signal Generator Configuration Guide,

p/n 5988-4085EN

For more information, visit our web site: [www.agilent.com/find/esg](http://www.agilent.com/find/esg)**Ordering Information****Frequency Ranges****E4438C-501** 250 kHz to 1 GHz (Electronic Attenuator Standard)**E4438C-502** 250 kHz to 2 GHz (Electronic Attenuator Standard)**E4438C-503** 250 kHz to 3 GHz (Electronic Attenuator Standard)**E4438C-504** 250 kHz to 4 GHz (Electronic Attenuator Standard)**E4438C-506** 250 kHz to 6 GHz (requires Option UNJ, Mechanical Attenuator only)**Performance Enhancements****E4438C-UNB** High Output Power with Mechanical Attenuator (for Option 501–504 Models only)**E4438C-UNJ** Enhanced Phase Noise Performance (includes 1E5)**E4438C-1E5** High-stability Time Base (Now included in all E4438Cs)**E4438C-1EM** Move all Front Panel Connectors to Rear**E4438C-601** Internal Baseband Generator with 8 Msamples with Digital Bus Capability**E4438C-602** Internal Baseband Generator with 64 Msamples with Digital Bus Capability**E4438C-003** Enables Digital Output Connectivity with N5102A**E4438C-004** Enables Digital Input Connectivity with N5102A**E4438C-005** 6 Gbyte Internal Hard Drive**E4438C-UN7** Internal Bit-error-rate Analyzer**E4438C-300** GSM/EDGE Base Station Loopback BERT**E4438C-HEC** External Baseband Clock Input**E4438C-HBC** Phase Coherent Carriers up to 6 GHz**E4438C-HCC** Phase Coherent Carriers up to 4 GHz**E4438C-UK6** Hardcopy of the Commercial Calibration Certificate and Calibration Test Data**Signal Creation Software<sup>1</sup>****E4438C-400** 3GPP W-CDMA Embedded Personality**E4438C-401** IS-95A and cdma2000 Embedded Personality**E4438C-402** TDMA Suite Embedded Personality**E4438C-403** Calibrated Noise (AWGN) Embedded Personality**E4438C-406** Signal Studio for Bluetooth**E4438C-407** Signal Studio for S-DMB**E4438C-409** GPS Embedded Personality**E4438C-419** Signal Studio for 3GPP WCDMA HSPA (HSDPA/HSUPA)**E4438C-SP1** Signal Studio for Jitter Injection**N7600B** Signal Studio for 3GPP WCDMA**N7601B** Signal Studio for 3GPP2 CDMA (IS95, cdma2000, 1xEV-DO Rev 0 & A)**N7612B** Signal Studio for TD-SCDMA**N7613A** Signal Studio for 802.16-2004 WiMAX (OFDM Fixed WiMAX)**N7615B** Signal Studio for WiMAX (OFDMA Mobile WiMAX)**N7616B** Signal Studio for T-DMB**N7617B** Signal Studio for 802.11 WLAN (a/b/g/p/j/n)**N7620A** Signal Studio for Pulse Building**N7621B** Signal Studio for Multitone Distortion (Enhanced Multitone and NPR)**N7622A** Signal Studio Toolkit**N7623B** Signal Studio for Digital Video (DVB-T/H/C/S, ATSC, ISDB-T, DTMB)**Manuals and Accessories****E4438C-1CM** Rackmount Flange Kit**E4438C-1CN** Front Handle Kit**E4438C-1CP** Rackmount Flange and Front Handle Kit**E4438C-CD1** CD-ROM containing the English Documentation Set**E4438C-ABA** Hardcopy of the English Documentation Set**E4438C-AB1** Hardcopy of the Korean User's Guide**E4438C-AB0** Hardcopy of the Chinese (Taiwan) User's Guide**E4438C-AB2** Hardcopy of the Chinese (China) User's Guide**E4438C-ABF** Hardcopy of the French User's Guide**E4438C-ABJ** Hardcopy of the Japanese User's Guide**E4438C-OBV** Hardcopy of the Component Level Service Manual**E4438C-OBW** Hardcopy of the Assembly Level Service Manual<sup>1</sup> Requires either Option 001, 002, 601 or 602 (baseband generator) to function.